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Epidemiology and Public Health at CDC

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Epidemiology is the study of the distribution and determinants of health-related states or events in specified populations and the application of this study to control health problems (1). However, in public health, the terms "field epidemiology" (2) and "applied epidemiology" (3)---which emphasize use of results in public health settings---define the practice of epidemiology at CDC. Epidemiology has been characterized as the basic science of public health (2), and its practice at CDC has shaped the agency's development and will contribute to its future success.

Epidemiology at CDC

Epidemiology at CDC began with Dr. Alexander Langmuir and his extraordinary contributions to CDC and to public health. Hired in 1949, Langmuir served as first Chief Epidemiologist at CDC and remained in that position until 1970 (4). In 1952, he convened the first Conference of State and Territorial Epidemiologists, which became the organization representing the approximately 2,500 epidemiologists working today in states. Langmuir defined disease surveillance at CDC (5), and this model since has become an established global public health practice. In 1961, Langmuir helped bring the *MMWR* to CDC to disseminate timely public health surveillance data and to communicate the results of public health investigations. He was an international consultant in epidemiology at the Winnipeg flood disaster of 1950; the radiation studies that followed the bombings at Hiroshima and Nagasaki, Japan; the global smallpox-eradication program; and other international issues of public health importance.

During the 1960s, CDC epidemiologists continued to work in infectious diseases domestically, especially drug-resistance in hospitals and *Salmonella* in commercial chicken products. A 1961 study of leukemia in Niles, Illinois (6), marked the first of several investigations of cancer clusters and the introduction of chronic disease epidemiology to CDC. Langmuir extended the scope of CDC epidemiology by initiating a family planning activity in 1963, and 4 years later, he established the Metropolitan Atlanta Congenital Defects Program.

Possibly Langmuir's most recognized contribution was the Epidemic Intelligence Service (EIS), a combined training and service program formed initially in response to the threat of bioterrorism (7). Since 1951, approximately 2,700 EIS officers have provided CDC and the states with a rapid-response capacity for any public health need in an estimated 10,000 investigations domestically and internationally (8). EIS-trained epidemiologists remain at CDC in leadership positions; others occupy prominent positions in other government agencies, academia, and international organizations.

One investigation put CDC and applied epidemiology in the public eye for the first time. On April 12, 1955 (the anniversary of the death of Franklin Roosevelt), the favorable results of the field trial of inactivated poliovirus vaccine were announced; 5 days later, a massive national vaccination campaign was initiated. However, within a week, paralytic polio was diagnosed in a child who had received the vaccine, and as new cases emerged, Langmuir was called on to investigate. A surveillance unit was set up and began issuing daily reports. On May 8, the U.S. Surgeon General declared a moratorium on the program. Using all the EIS officers and working with the states, CDC established the association with two lots of vaccine from one manufacturer, cleared the other four manufacturers, and persuaded public authorities by June 1 to restart the program (9).

The 1970s saw an expanding role for epidemiology at CDC. CDC epidemiologists identified contaminated bottles of intravenous fluid, leading to a national recall; linked liver cancer in certain workers with exposure to vinyl chloride; played a pivotal role in the global eradication of smallpox; identified Ebola virus in Zaire and the Sudan; identified toxic-shock syndrome; and uncovered the association between aspirin use and Reye syndrome. The Cancer and Steroid Hormone Study, conducted in collaboration with the National Cancer Institute, and the Study of the Efficacy of Nosocomial Infection Control were important not only for their findings but also for the introduction of large numbers of analytic epidemiologists and statisticians to CDC. The 1976 investigation of Legionnaires disease in Pennsylvania highlighted collaboration between laboratory scientists and epidemiologists in the discovery of new and important pathogens (10). Field epidemiology training programs established in Canada and Thailand were the first of now 34 EIS-like programs around the world (11).

Acquired immunodeficiency syndrome dominated the 1980s and, together with expansion of agency programs in noninfectious diseases, added behavioral and social scientists to CDC's team of epidemiologists, statisticians, and laboratory scientists. Infectious diseases---notably *Escherichia coli* O157:H7 associated with hemorrhagic diarrhea and hemolytic-uremic syndrome---remained important. However, studies of chronic diseases, violence, disasters, refugees, and toxic exposures to both environmental and commercial products such as cooking oil, medications, diet supplements, and paint engaged increasing numbers of epidemiologists.

Since 1990, CDC epidemiologists have collaborated with an expanding array of partners around the world to tackle noninfectious diseases and injuries, as well as emerging infections, such as hantavirus, cryptosporidiosis, West Nile virus, severe acute respiratory syndrome, and the threat of pandemic influenza. Global eradication programs in polio and dracunculiasis (guinea worm disease) engage a global network of epidemiologists with the World Health Organization, international governments, and the private sector. Prevention effectiveness and informatics have been added to the epidemiologist's toolkit. Hundreds of epidemiologists were deployed to address disasters at the World Trade Center and the anthrax poisonings in 2001 and hurricanes Katrina and Rita in 2005.

The Role of the Epidemiologist in the Future

CDC epidemiologists will continue to respond to emergent events, be they newly emerging infections, natural disasters, or terrorism, and will continue to study public health problems, such as unintentional injuries, environmental exposures, cardiovascular disease, obesity, tobacco use, and violence domestically and internationally (12). Public and private partners on the public health team will expand to include new disciplines. The analytic tools and technologies available will increase, and CDC epidemiologists will maintain a critical role in capacity building. Finally, CDC epidemiologists must maintain the scientific integrity the agency has established by remaining rigorous yet adaptable to the challenges new global realities bring to public health.

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